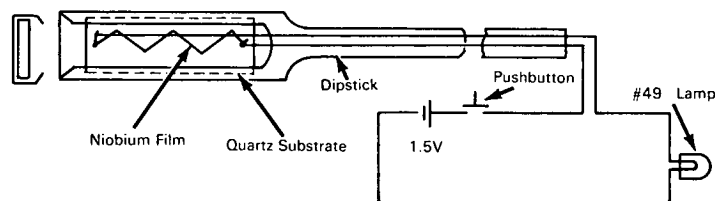


NASA TECH BRIEF



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Superconductive Thin Film Makes Convenient Liquid Helium Level Sensor



A convenient sensor for measuring the level of liquid helium in a Dewar flask consists of a superconductive film mounted on a dipstick. The sensor is made by depositing a thin film of niobium metal to a thickness of approximately 2000 angstroms on a quartz substrate, which is then mounted on a graduated dipstick. The film deposition is carried out, on the substrate at 600°F, in a vacuum of approximately 10^{-6} torr (with an electron beam evaporation source) at an evaporation rate of approximately 1500 angstroms per minute. These conditions are required to obtain large crystallites in the niobium thin film for onset of superconductivity slightly above 4.2° K (temperature of boiling liquid helium). For a sensor on a quartz substrate measuring $1/16 \times 3/8 \times 1$ inch, the electrical resistance of the device is 200 ohms at room temperature.

To use the sensor as a gage for measuring the level of liquid helium, the niobium film is connected in series with a 1.5 volt battery, a No. 49 indicating lamp, and a normally open pushbutton switch. With the pushbutton closed, the top of the dipstick is held with thermally insulated gloves and the sensor is slowly and cautiously lowered into the Dewar until the indicator lamp lights. At this point, contact of the sensor with the liquid helium surface reduces the temperature of the sensor to that of the liquid helium and the resistance of the sensor suddenly falls to zero, permitting sufficient current from the battery to light

the lamp. The reading on the dipstick then corresponds to the liquid level. Once turned on, the lamp will remain lit (with the switch closed) as long as the sensor is immersed in the liquid or is surrounded by helium vapor immediately above the liquid surface. To obtain a second level reading, the sensor is lifted a few inches above the liquid surface so that the lamp will automatically extinguish. The dipstick is again lowered into the Dewar flask until the lamp again turns on, indicating contact of the sensor with the liquid surface. A second level reading is taken on the dipstick, as in the first measurement, and the two readings are averaged. By this method, the level or depth of the liquid helium may be measured to an accuracy of ± 0.25 inch.

Note:

Details may be obtained from:
Technology Utilization Officer
Langley Research Center
Langley Station
Hampton, Virginia 23365
Reference: B68-10341

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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Category 01